TAMPA ELECTRIC

January 27, 2000

Attn: Electric Utility Steam Generating Unit
Mercury Test Program
Mr. William Grimley
U.S. Environmental Protection Agency
Emissions Measurement Center
4930 Old Page Road, Room No. E-108
Durham, North Carolina 27709

Via FedEx
Airbill No. 7910 3743 6780

Re: Tampa Electric Company (TEC) – Polk Power Station Unit No. 1
Mercury Information Collection Request (ICR) Part III Submittal of the Emissions Test Report

Dear Mr. Grimley:

Please find enclosed two (2) bound and one (1) unbound copies of the test report for the ICR mercury speciation test program performed at TEC's Polk Power Station Unit No. 1 on November 2, 1999.

Should you have any questions or concerns regarding the enclosed Emissions Test Report, please contact me at (813) 641-5034.

Sincerely,

Linda M. Kong

Linda M. Kong
Associate Engineer
Environmental Planning

EP\gm\LMK109

Enclosure (3)

c: Mr. Howard Rhodes, FDEP
Mr. Winston A. Smith, EPA/RO IV
Mr. William Maxwell, EPA/ESD

WESTON PROJECT NO. 12281.001.001
EMISSIONS TEST REPORT
TAMPA ELECTRIC COMPANY
POLK POWER STATION
POLK COUNTY, FLORIDA

JANUARY 2000

INFORMATION COLLECTION REQUEST ASSESSMENT OF SPECIATED MERCURY EMISSIONS FROM A COAL-FIRED POWER GENERATOR

Prepared for:

TAMPA ELECTRIC COMPANY
5010 Causeway Blvd.
Tampa, Florida 33619

Prepared by:

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1. INTRODUCTION

1.1 SUMMARY OF THE TEST PROGRAM

The U.S. Environmental Protection Agency (EPA), Office of Air Quality Planning and Standards (OAQPS) has undertaken a program to acquire information related to mercury emissions from electric utility coal fired units. As part of this Information Collection Request (ICR), EPA has selected certain utilities for emissions testing to characterize speciated mercury emissions and the effectiveness of available control measures on such emissions.

Tampa Electric Company (TEC) Polk Power Station located in Polk County, Florida was selected as one of the ICR study sites. Mercury speciation sampling was performed on Unit No. 1 at the Polk Power Station using the Ontario Hydro method. During the ICR test program mercury speciation testing was performed on the outlet of the combustion turbine and heat recovery steam generator which is fired by synthetic gas (syngas) produced in a coal gasification system.

The mercury speciation sampling activities were performed by Roy F. Weston Inc. (WESTON®), coal sampling was performed by TEC, the analysis of the coal and Ontario Hydro method samples were performed by Philip Analytical Services. The test program was performed during the period of November 1 and 2, 1999.

This test report presents the test data and test results of the mercury speciation sampling program performed on Unit No. 1 at the TEC Polk Power Station and contains all test results and discussions. Appendices of the detailed test data and test results, raw test data, process data, laboratory reports, equipment calibration records and sample calculations are also provided. This report format follows EPA's Emissions Measurement Center (EMC) guideline document (GD-043) titled, Preparation and Review of Emission Test Reports which is required for ICR report submittals.

1.2 TEST PROGRAM OBJECTIVES

During the test program mercury emissions testing using the Ontario Hydro method were performed on the outlet of the Unit No. 1 stack. Representative samples of the coal introduced to the coal gasification system were sampled in conjunction with the emissions testing.

The specific objectives of this test program were as follows:

- Characterize the emissions of particulate-bound, elemental and oxidized mercury from the combustion turbine and heat recovery steam generator.
- Obtain and analyze representative samples of the coal for the purpose of determining mercury, heating value, ash content, sulfur and chlorine levels.
- Document corresponding coal gasification system, turbine and steam generator operations along with facility continuous emission monitoring system (CEMs) data.

A Site-Specific Sampling/Testing, Analytical and QA/QC Plan and Quality Assurance Project Plan (QAPP) dated June 1999 were developed for the ICR test program performed on Unit No. 1.

1.3 SAMPLE LOCATIONS

Representative samples from the following solid stream were collected and analyzed during the test program:

- Coal Feed.

Flue gas stream emission samples were collected at the following location:

- Unit No. 1 Outlet (stack).

In addition to the coal samples collected during the emission test period, representatives of TEC collected a grab sample of the syngas during each test run. The syngas was analyzed for heating value. The syngas was also analyzed for refinery gas parameters. See Appendix D for a summary of the syngas analytical results.

1.4 POLLUTANTS MEASURED

Table 1-1 presents a summary of process solid and flue gas streams and the associated pollutants and parameters measured during the test program.

1.5 TEST PROGRAM KEY PERSONNEL

The key personnel who coordinated and performed the test program, their project responsibilities and their phone numbers are:

Contact Name	Project Responsibility	Telephone No.	Facsimile No.
TEC			
Mr. David Smith	Corporate Environmental Services Contact	(813) 630-7382	(813) 630-7350
Mr. David Knapp	Facility Environmental Contact	(813) 228-4111 x(39109)	(813) 228-4111 x(39927)
EPA			
Mr. William Grimley	ICR Program Manager	(919) 541-1065	(919) 541-1039
WESTON			
Mr. Jeff O'Neill	Project Manager	(610) 701-7201	(610) 701-7401
Mr. Jack Mills	Test Team Leader	(610) 701-7245	(610) 701-7401
PHILIP			
Mr. Vaughn O'Neill	Laboratory Analyst	(610) 921-8833	(610) 921-9667

Table 1-1

Polk Power Station
Unit No. 1
Process Solid and Flue Gas Streams with Pollutants/Parameters

Location/Stream Type	Pollutants or Parameters	Frequency
Unit No. 1 Coal Feed	Heating value Ash content Moisture Mercury (Hg) content Chlorine (Cl) content Sulfur content	One composite sample per run (total of 3) in conjunction with flue gas sampling on Unit No. 1
Syngas	Heating Value[1]	One grab sample per run (total of 3) in conjunction with flue gas sampling on Unit No. 1
Unit No. 1 Outlet (Stack)	Particulate bound and vapor phase mercury (including oxidized and elemental mercury speciation of vapor phase).	Outlet sampling by Ontario Hydro method on Unit No. 1 stack.

[1] Additional analysis for refinery gas parameters were performed (See Appendix D).

2. PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 POLK POWER STATION UNIT NO. 1 OVERVIEW

Tampa Electric Company operates Polk Unit No. 1, which is a 1755 MMBtu/hr combustion turbine and heat recovery steam generator at the Polk Power Station located in Polk County, Florida. The unit is fired with syngas produced by a coal gasification system. The combustion turbine is designed to operate at a full load of 192 megawatts (MW).

There are no post-combustion emission control systems.

The continuous emissions monitoring system (CEMs) measures the effluent concentration of sulfur dioxide (SO_2), carbon dioxide (CO_2), oxides of nitrogen (NO_x), volumetric flow rate and opacity in the gas stream at the outlet stack location.

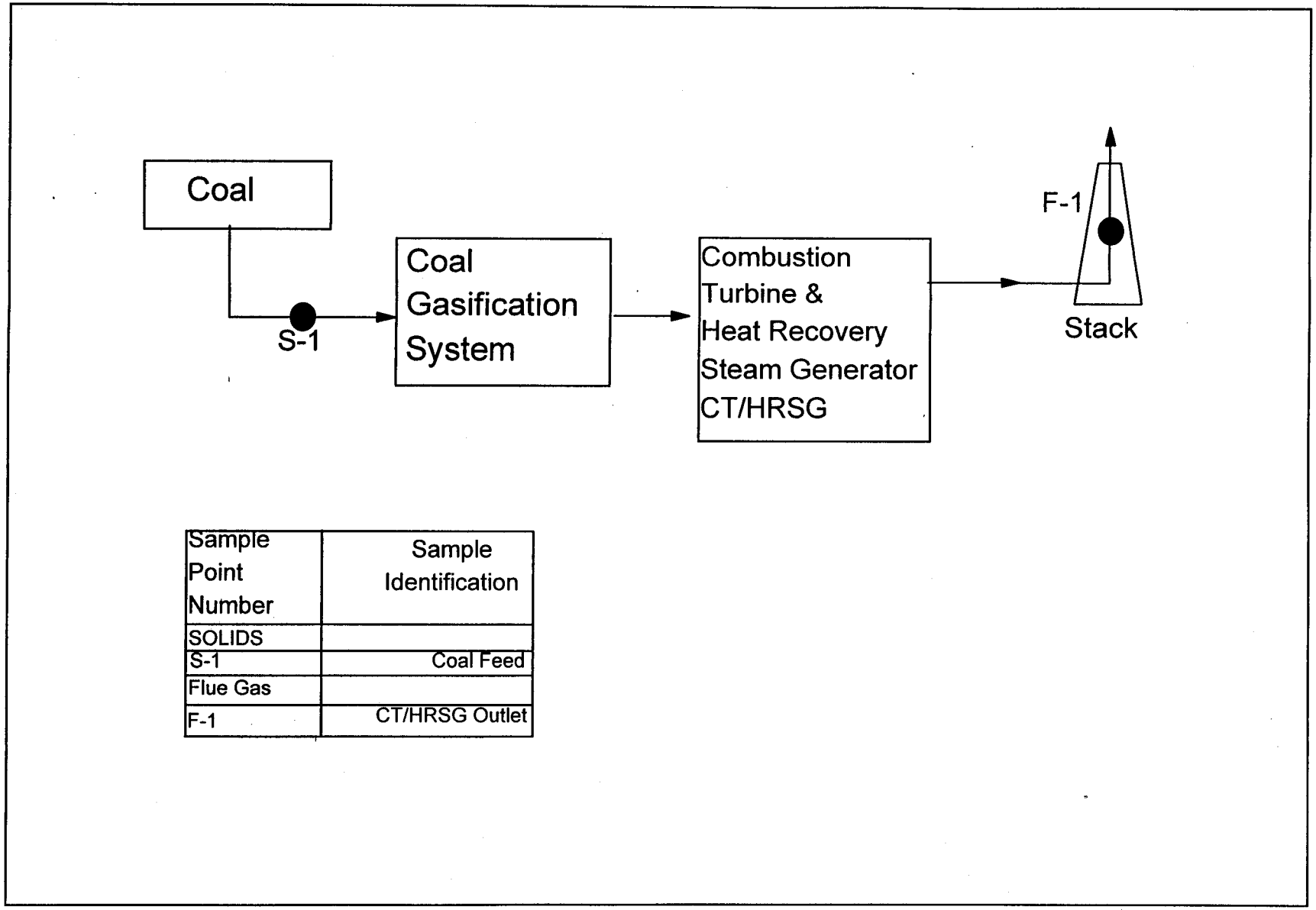
Figure 2-1 presents a schematic of the Unit No. 1 process.

2.2 PROCESS SOLID SAMPLING LOCATIONS AND SAMPLING PROCEDURES

2.2.1 Unit No. 1 Coal Sampling

From a storage silo, coal is conveyed to two coal feeders prior to introduction to the coal crushers. Samples of the coal feed stream were obtained directly from the two coal feeders. A scoop sampler was used to obtain approximately 1 pound subsamples from each of the two feeders every 30 minutes during each test run.

There is an approximate 8-hour retention time between when the coal is fed to the crushers and the resulting syngas is combusted in the turbine. Therefore, coal sampling was initiated 8-hours prior to the start of the Unit No. 1 emission testing. Following completion of emission testing the coal samples were composited for each test run based on the emission test time period taking the 8-hour time difference into account.



Sample Point Number	Sample Identification
SOLIDS	
S-1	Coal Feed
Flue Gas	
F-1	CT/HRSG Outlet

FIGURE 2-1
PROCESS SCHEMATIC AND SAMPLING/TESTING LOCATIONS
TECO-POLK POWER STATION UNIT NO. 1

c:\freelance drawings/POLKfig2-1

2.3 FLUE GAS SAMPLING LOCATIONS

2.3.1 Unit 1 Outlet (Stack)

A total of four (4) test ports are in place on the 19′ ID flue. The test ports are located ~60′ (3.1 diameters) downstream from the nearest disturbance (breechings from turbine) and 14′ (0.7 diameters) from the nearest upstream distance (stack exit).

A total of 6 points per port (24 total) were sampled. See Figure 2-2 for a schematic of the Unit No. 1 stack test location.

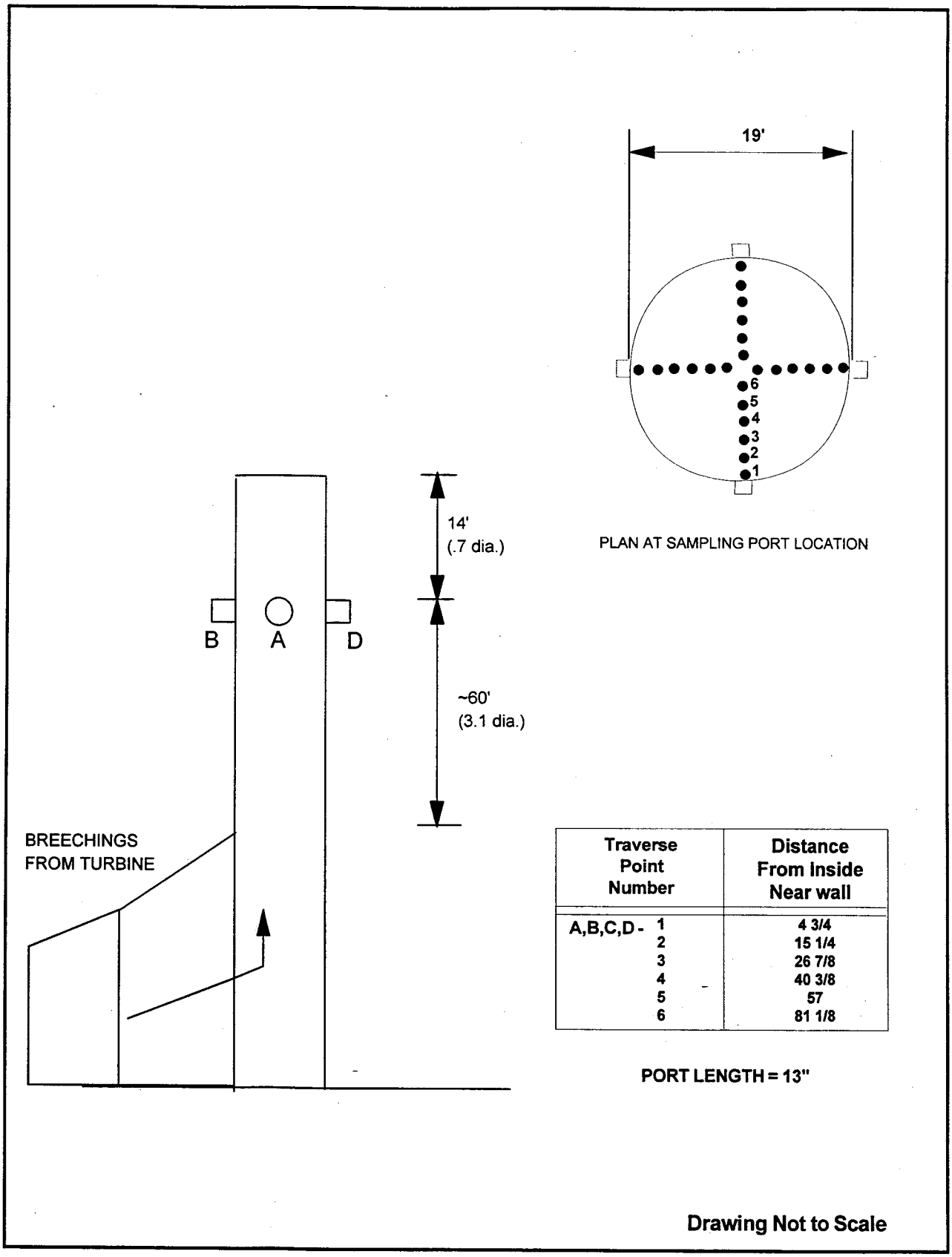


Figure 2-2
UNIT 1 STACK TEST SITE
PORT AND TRAVERSE POINT LOCATIONS

3. SUMMARY AND DISCUSSION OF TEST RESULTS

3.1 SAMPLING/TESTING, ANALYTICAL AND QC MATRICES

The detailed sampling/testing, analytical and QC matrices for this survey are presented on Tables 3-1 and 3-2 for the coal, and flue gas sampling location, respectively. Each table specifies the following components:

- Sampling point identification and description.
- Test objective, number and length of test runs performed, and samples/data collected.
- Parameters measured.
- Sampling or monitoring methods employed, including sample preservation technique.
- Maximum sample holding time.
- Sample preparation/extraction and analysis methods applied.
- Sampling and analytical program design (i.e., number of samples collected/analyzed by type and method). This includes the number, or frequency and type, of QC samples analyzed for each parameter.
- Laboratory that analyzed each type of sample.

3.2 PRESENTATION OF RESULTS

3.2.1 Mercury Speciation Test Results

A summary of the Ontario Hydro method mercury speciation test results are presented on Tables 3-3 and 3-4 for Unit No. 1.

Table 3-3 presents the measured mercury concentrations in micrograms per cubic meter (ug/m^3) for each test run and provides the percent of particulate, oxidized and elemental mercury in comparison to the total mercury.

Table 3-4 presents the mercury concentrations and mass rate values for particulate, oxidized, elemental and total mercury for each individual test runs along with the measured

Table 3-1

Sampling/Testing, Analytical, and QC Plan
Unit No. 1 — Clean Coal Feed

No. of Test Runs: 3

Test Objective: Determine total mercury and chlorine content of as-fired coal.

Sampling Objective: Collect a representative sample.

Parameters to be Determined:	**Mercury**	**Chlorine**	**Heating Value**	**Ash Content**	**Sulfur Content**	**Mass Flow Rate**
Sampling or Monitoring Method:	Representative sample increments were obtained from the two (2) individual coal feeders once every 30 minutes during each test period. Samples stored in air-tight, plastic-lined bucket					Gravimetric feeder readings recorded in control room
Sample Preparation/Extraction and Analysis Method(s):	ASTM D2013 and EPA Method 7471	ASTM E776 and EPA Method 300	ASTM D3286	ASTM D3174	ASTM D4239	
Maximum Holding Time (days):	28	28	28	28	28	NA
Sampling or Monitoring Design:						
Total No. of Samples	3	3	3	3	3	NA
Site Blanks	0	0	0	0	0	NA
Trip Blanks	0	0	0	0	0	NA
Lab Blanks	1	1	1	1	1	NA
Blank Spikes[2]	0	0	0	0	0	NA
Replicates[3]	1 batch	1/batch	1/batch	1/batch	1/batch	NA
QC Spikes[4]	1/batch[1]	1/batch	1/batch	1/batch	1/batch	NA
Total No. of Samples Analyzed	6	6	6	6	6	NA
Analytical Laboratory:	Philip Analytical Services					NA

Notes: [1]A batch consists of a maximum of 20 samples.

[2]A blank spike (or method spike) is a sample of reagent-grade water spiked with the analyte(s) of interest that is prepared and analyzed with the associated sample batch.

[3]This indicates that a duplicate analysis is made on one or more samples as a QC mechanism to measure analytical precision.

[4]A sample of similar matrix is spiked with a known amount of the analyte(s) of interest to determine percent recovery.

Table 3-2

Sampling/Testing, Analytical, and QC Plan
Unit No. 1 Outlet

No. of Test Runs: 3 per unit
Test Objective: Perform mercury speciation sampling at outlet of Unit No. 1.
Sampling Objective: Collect a representative sample.

Parameters to be Determined:	Speciated Mercury
Sampling or Monitoring and Preservation Method(s)	Ontario Hydro Method
Sample Preparation/Extraction and Analysis Method(s):	Ontario Hydro Method
Maximum Holding Time (days):	28
Sampling or Monitoring Design:	
Length of Test:	≥ 120 min
Sample Size	1 to 2.5 m^3
Total No. of Samples	3 at outlet
Site/Reagent Blanks	Minimum of 1 per sample type
Train Blanks	1 per location
Lab Blanks	1 per batch[1]
Blank Spikes[2]	1 per batch
Replicates[3]	All samples
Total No. of Samples Analyzed[4]	~50
Analytical Laboratory:	Philip Analytical Services

[1]A batch consists of a maximum of 10 samples.
[2]A blank spike (or method spike) is a sample of reagent-grade water spiked with the analyte(s) of interest that is prepared and analyzed with the associated sample batch.
[3]This indicates that a duplicate analysis is made on one or more samples as a QC mechanism to measure analytical precision.
[4]Approximate number of total samples and individual fractions, duplicates and other QC samples.

Note: The facility CEMs measured sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon dioxide (CO_2), flow and opacity on the Unit No. 1 outlet stack.

TABLE 3-3
COMPARISON OF MERCURY SPECIATION TO TOTAL MERCURY RESULTS
UNIT NO. 1 STACK

Mercury Species	Unit No. 1 Stack						
	Run 1		Run 2		Run 3		Average
	(ug/m^3)	% of Total	(ug/m^3)	% of Total	(ug/m^3)	% of Total	% of Total
Particulate Bound Mercury Emissions	< 0.01	< 0.24	< 0.01	< 0.25	< 0.01	< 0.26	0.25
Oxidized Mercury Emissions	0.39	9.87	0.31	7.92	0.13	3.46	7.08
Elemental Mercury Emissions	3.55	89.89	3.55	91.83	3.55	96.28	92.67
Total Mercury Emissions	3.95	100.00	3.87	100.00	3.69	100.00	100.00

TABLE 3-4
TEC - POLK POWER STATION
SUMMARY OF MERCURY SPECIATION TEST DATA AND TEST RESULTS
UNIT NO. 1 STACK

TEST DATA:									
Test run number		1		2		3			
Location		Unit No. 1 Stack		Unit No. 1 Stack		Unit No. 1 Stack			
Test date		11/2/99		11/2/99		11/2/99			
Test time period		0755-1043		1200-1525		1654-1948			
PROCESS DATA:									
Unit Load, Total MW		318		318		317			
Combustion Turbine, MW		191		191		191			
Steam Turbine, MW		127		127		126			
Coal feed rate, Klb/hr.		224		219		177			
Coal Btu content, Btu/lb.		10770		11550		11520			
Heat Input, 10^6 Btu/hr		2408		2531		2041			
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:									
Avg. gas stream velocity, ft./sec.		82.0		83.4		80.8		AVERAGE	
Avg. gas stream volumetric flow, wacf/min.		1395491		1419237		1374791		1396506	
Avg. gas stream volumetric flow, dscf/min. (1)		841800		855600		832300		843200	
PARTICULATE BOUND MERCURY EMISSIONS:									
Conc., ug/m^3	<	0.01	<	0.01	<	0.01	<	0.009	
Conc., ug/Nm^3 (2)	<	0.01	<	0.01	<	0.01	<	0.010	
Emission rate, lbs/10^{12} Btu.	<	0.01	<	0.01	<	0.01	<	0.01	
Emission rate, lbs/hr	<	2.96E-05	<	3.07E-05	<	2.95E-05	<	2.99E-05	
OXIDIZED MERCURY EMISSIONS:									
Conc., ug/m^3		0.39		0.31		0.13		0.27	
Conc., ug/Nm^3 (2)		0.42		0.33		0.14		0.29	
Emission rate, lbs/10^{12} Btu.		0.51		0.39		0.19		0.36	
Emission rate, lbs/hr		1.23E-03		9.82E-04		3.98E-04		8.69E-04	
ELEMENTAL MERCURY EMISSIONS:									
Conc., ug/m^3		3.55		3.55		3.55		3.55	
Conc., ug/Nm^3 (2)		3.81		3.81		3.81		3.81	
Emission rate, lbs/10^{12} Btu.		4.65		4.50		5.42		4.86	
Emission rate, lbs/hr		1.12E-02		1.14E-02		1.11E-02		1.12E-02	
TOTAL MERCURY EMISSIONS: (3)									
Conc., ug/m^3		3.95		3.87		3.69		3.83	
Conc., ug/Nm^3 (2)		4.24		4.15		3.96		4.11	
Emission rate, lbs/10^{12} Btu.		5.17		4.90		5.63		5.23	
Emission rate, lbs/hr		1.24E-02		1.24E-02		1.15E-02		1.21E-02	

(1) Standard conditions = 68 deg. F. (20 deg. C.) and 29.92 inches Hg (760mm Hg).
(2) Nm3 = Normal cubic meter (32 deg. F. (0 deg. C.) and 29.92 inches Hg (760mm Hg)).
(3) Non-detects included in total mercury catch value.

volumetric flow rates. Average values with the standard deviation (SDEV) and percent relative standard deviation (% RSD) have been calculated and are presented.

3.2.1.1 Unit No. 1

For the Unit No. 1 outlet an average of < 1 percent of the total mercury measured was particulate bound mercury. On average the oxidized mercury was 7 percent of the total and the elemental mercury accounted for 92.7 percent of the total mercury collected.

The average total mercury emission rates for Unit No. 1 were 3.83 ug/m^3, 5.21 lbs/10^{12} Btu and 0.012 lb/hr.

3.2.2 Process Solid Sample Stream Results

Table 3-5 provides a summary of the analytical results obtained on the coal feed samples collected on Unit No.1.

For each parameter measured on the Unit No. 1 coal feed stream, the concentration or percent value is presented (on or as received basis) for each individual test run along with the average values.

Detailed analytical summaries are provided in Appendix D of this report.

Based on the mercury content of the coal [< 0.1 milligram per kilogram (mg/kg)], and the average measured coal feed rate of 207,000 lb/hr, the mass rate of mercury introduced to the gasifier averaged < 0.0207 lb/hr. A detection limit value for mercury was reported for all three composite coal samples.

3.2.3 Unit Operation and Key Operational Parameters

This section describes the Unit No. 1 operations during the test program and provides the key operating parameters that were monitored and documented during testing.

TABLE 3-5

SUMMARY OF COAL SAMPLE RESULTS
UNIT NO. 1 COAL FEED SAMPLES

Parameter[1]	Test Run No.			
	1	2	3	Average
Mercury,ppm (mg/kg)	< 0.1	< 0.1	< 0.1	< 0.1
Chlorine, %	0.10	0.09	0.10	0.10
Heating value, Btu/lb	10770	11550	11520	11280
Ash, %	11.8	9.03	8.60	9.81
Sulfur, %	2.80	2.79	2.99	2.86
Moisture, %	9.99	10.70	11.10	10.60

(1) As received basis.

3.2.3.1 *Unit Operation During Testing*

Operation of Unit No. 1 during testing was representative of normal daily operation at or near full load. Steady-state testing conditions were maintained during all test periods.

3.2.3.2 *Process Control Data*

All key power generation process operating parameters and control data were recorded during each test period. Coal gasification, turbine and generator operational indicators data were recorded by a data acquisition system. The facilities CEMs data acquisition system provided concentration values.

A summary of the key operating data is provided in Table 3-6 for Unit No. 1. All additional operations data and CEM data are provided in Appendix B.

3.3 TESTING PROBLEMS OR MODIFICATIONS

No sampling or analytical problems were noted during the test program. No process problems were noted during any of the test periods.

Table 3-6
Summary of Key Process Control Data
Unit No. 1

Parameter	Units	Run No.		
		1	2	3
Gross generation	MW	317.6	317.8	316.7
Combustion Turbine	MW	190.7	190.7	190.8
Steam Turbine	MW	126.9	127.1	125.9
Net generation	MW	249.9	249.1	248.3
Coal total	lbs/hr	224,000	219,000	177,000
Main steam flow	10^3 lb/hr	678.3	680.1	672.3
Main steam temp.	°F	1001.0	1001.0	1001.0
Stack gas flow (CEMs)	kscfh	56862.0	55852.0	56717.0
Stack opacity	%	1.1	0.9	0.7
Stack CEMs (SO_2)	ppm/v	34.8	39.8	23.2
Stack CEMs (NO_x)	ppm/v	24.7	24.5	25.0
Stack CEMs (SO_2)	lb/MMBtu	0.17	0.19	0.11
Stack CEMs (NO_x)	lb/MMBtu	0.084	0.082	0.084
Stack CEMs (CO_2)	%	8.2	8.2	8.2
Syngas mass flow	lb/sec	104.0	104.2	103.5
N_2 mass flow	lb/sec	120.8	122.8	123.5
Syngas pressure	psi	197.0	196.6	195.8
Syngas gross heating value[1]	Btu/cf	261.5	259.5	262.0
Barometric pressure	in Hg	29.53	29.50	29.53
Ambient temperature	°F	78	79	78

(1) See additional syn gas analysis results provided in Appendix D.

4. SAMPLING AND ANALYTICAL PROCEDURES

4.1 DESCRIPTION OF SAMPLING EQUIPMENT

4.1.1 Ontario Hydro Mercury Speciation Method

The Ontario Hydro sampling train contained the following components:

- A calibrated borosilicate nozzle was attached to a borosilicate thimble holder containing a high capacity in-stack quartz fiber thimble using an EPA Method 17 configuration.
- The thimble holder was attached to a heated borosilicate probe equipped with a calibrated thermocouple to measure flue gas temperature and a calibrated S-type pitot tube to measure flue gas velocity pressure.
- An impinger train consisting of eight impingers. The first, second, and third impingers each contained 100 ml of 1 Normal (N) potassium chloride (KCl). The fourth impinger contained 100 ml of 5% nitric acid (HNO_3) and 10% hydrogen peroxide (H_2O_2). The fifth, sixth and seventh impingers each contained 100 ml of 4% potassium permanganate ($KMnO_4$) and 10% sulfuric acid (H_2SO_4). The eighth impinger contained 300 grams of dry preweighed silica gel. The third and seventh impingers were a Greenburg-Smith type; all other impingers were of a modified design. All impingers were maintained in a crushed ice bath.
- A vacuum line (umbilical cord) with adapter to connect the outlet of the impinger train to a control module.
- A control module containing a 3-cfm carbon vane vacuum pump (sample gas mover), a calibrated dry gas meter (sample gas volume measurement device), a calibrated orifice (sample gas flow rate monitor) and inclined manometers (orifice and gas stream pressure indicators).
- A switchable calibrated digital pyrometer to monitor flue and sample gas temperatures.

See Figure 4-1 for a schematic of the Ontario Hydro test train.

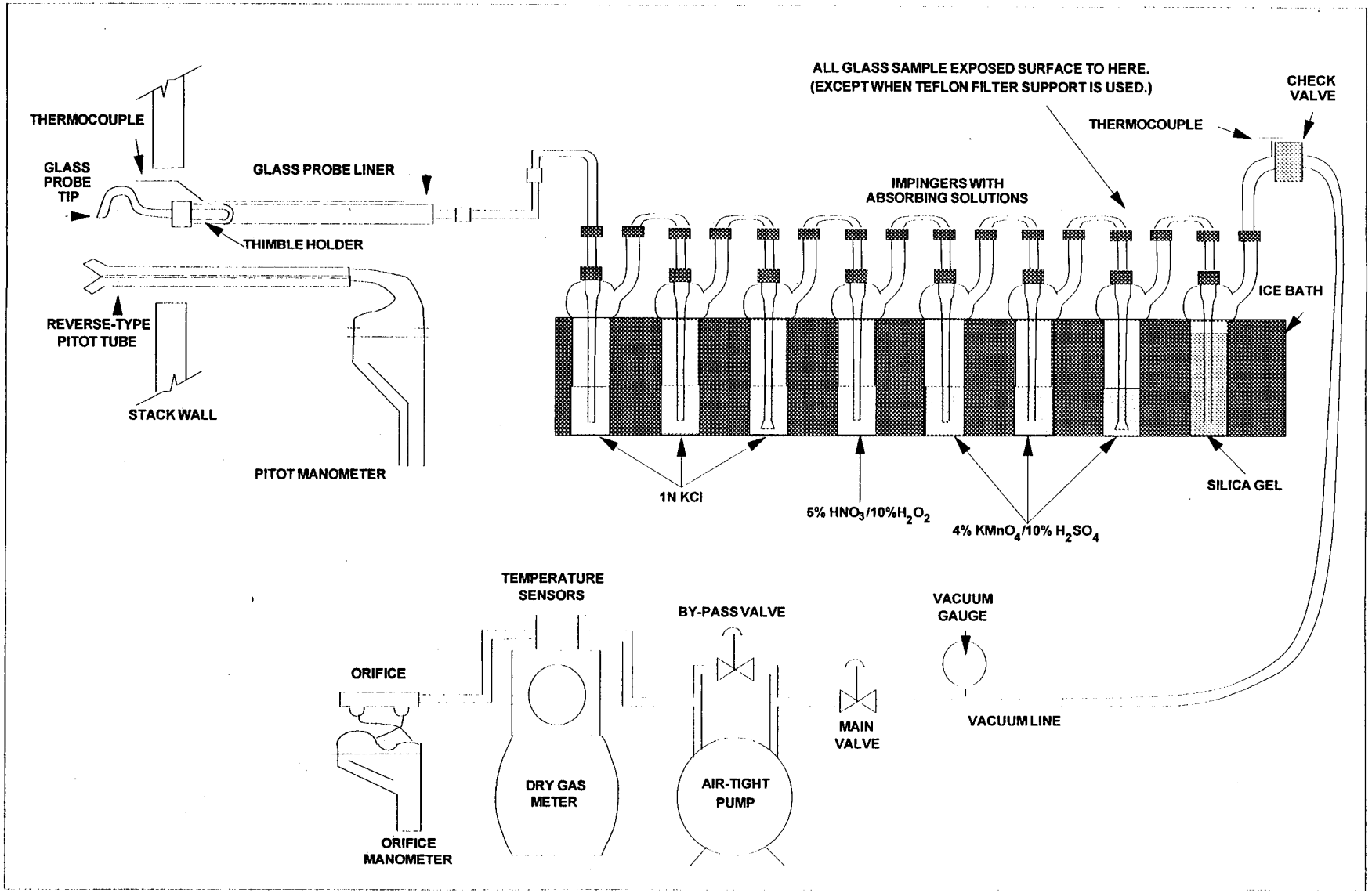


FIGURE 4-1
STACK TEST LOCATION
ONTARIO HYDRO SAMPLING TRAIN

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4.2 CO_2 AND O_2 SAMPLING EQUIPMENT

The fixed gases sampling train (Figure 4-2) used at the Unit No. 1 outlet test site was assembled in accordance with EPA Method 3 and consisted of the following components:

- A stainless steel probe (fastened to the Ontario Hydro sampling probe) with a plug of glass wool to remove particulate.
- An ice-cooled condenser to remove moisture from the sampled gases.
- A diaphragm pump to draw a sample of the gases.
- A valve and rate meter to control and monitor gas stream sampling rates, respectively.
- A Tedlar® bag to contain the sample of flue gases.

For Unit No. 1, the CO_2 and O_2 concentrations of each bag were analyzed using an Orsat analyzer per EPA Method 3 procedure.

4.3 SAMPLING PROCEDURES

The following paragraphs and flow charts summarize the procedures used to sample the flue gases, recovery of the resultant samples and analyze the samples.

4.3.1 Preliminary Tests

Following equipment setup, preliminary test data was compiled at the emission test site to verify pretest data/assumptions, determine nozzle sizes, and compute isokinetic sampling rates.

Test site geometric measurements were measured and sampling point distances were recalculated. A pitot traverse was performed to determine velocity profiles and to check for the presence/absence of cyclonic flow at the site. The cyclonic flow check proved negative at the test location. As appropriate, flue gas temperatures, dry gas composition, and moisture content were also determined by EPA Reference Methods 2, 3, and 4, respectively.

The preparation, sampling, and recovery procedures used to sample the emission points for speciated mercury conformed to those specified in the draft Ontario Hydro method and as described

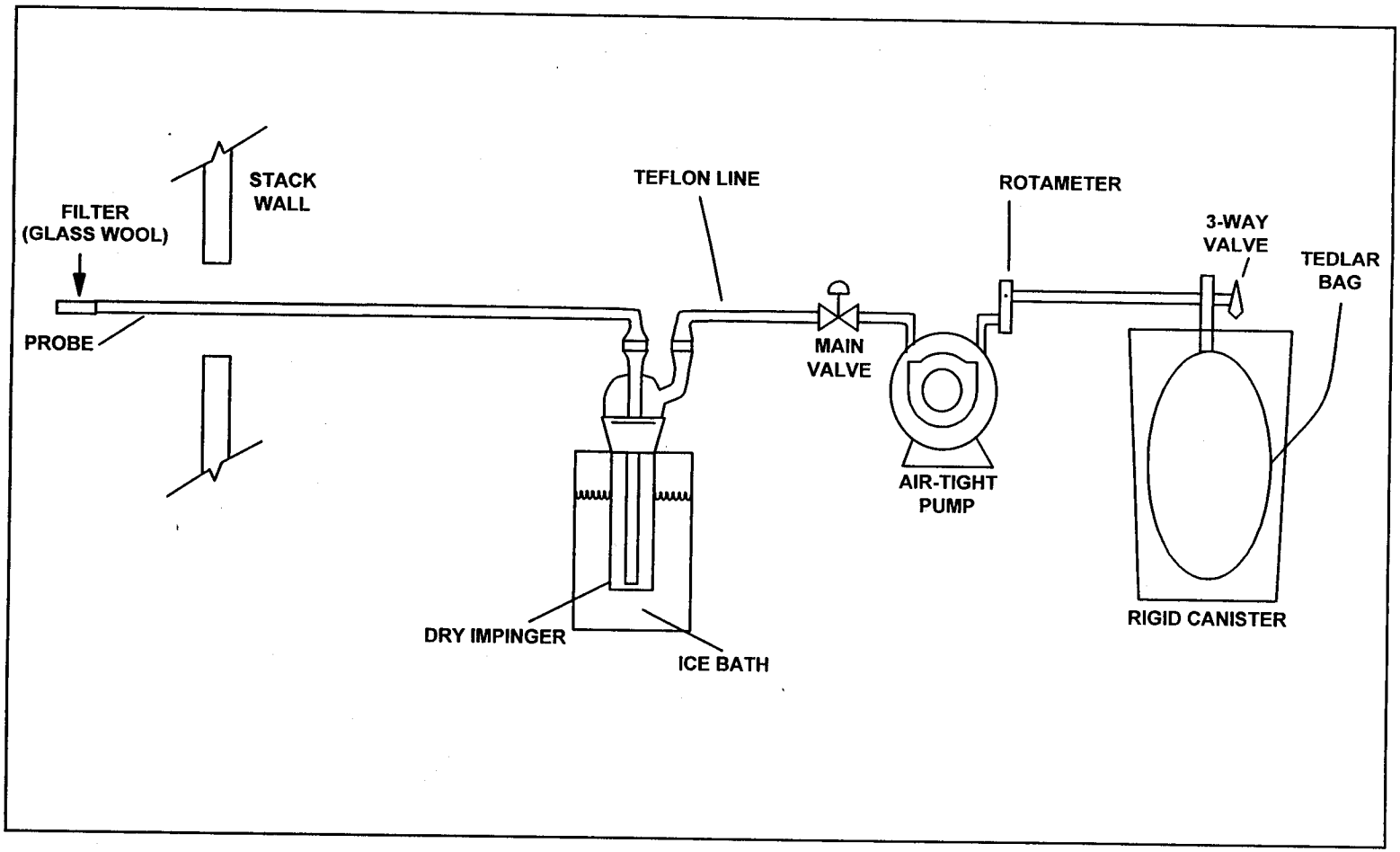

FIGURE 4-2
EPA METHOD 3 - DRY GAS STREAM COMPOSITION SAMPLING TRAIN

in the Site-Specific Sampling/Testing, Analytical and QA/QC plan. Each test run was 120 minutes in duration with readings taken at each of the 24 traverse points once every 4 minutes. Leak checks were performed at the beginning and end of each test run and before and after test port changes. Figure 4-3 illustrates the train preparation. Figure 4-4 illustrates the sampling procedures. Figure 4-5 illustrates the sample recovery procedures.

4.4 ANALYTICAL PROCEDURES

4.4.1 Sample Analyses

4.4.1.1 Ontario Hydro Sample Analyses

Figure 4-6 presents a schematic of the analytical procedures used during analysis of the Ontario Hydro samples.

4.4.1.2 Coal Sample Analyses

4.4.1.2.1 Preparation

Preparation of the coal samples followed ASTM Method D-2013. Following air drying and riffling the coal sample was pulverized until 100% of the sample passed a 60-mesh screen.

4.4.1.2.2 Chlorine

The prepared coal sample was weighed. The weighed sample was oxidized by combustion in a bomb with a bicarbonate/carbonate solution and the amount of chlorine present determined by ion-chromatography (IC) using EPA Method 300 procedures.

4.4.1.2.3 Mercury

Following preparation the coal sample was weighed. The sample was then digested in sulfuric acid, nitric acid and potassium permanganate.

Following digestion the liquid sample was analyzed for total mercury content using cold vapor atomic absorption (CVAA) by EPA Method 7471 procedures.

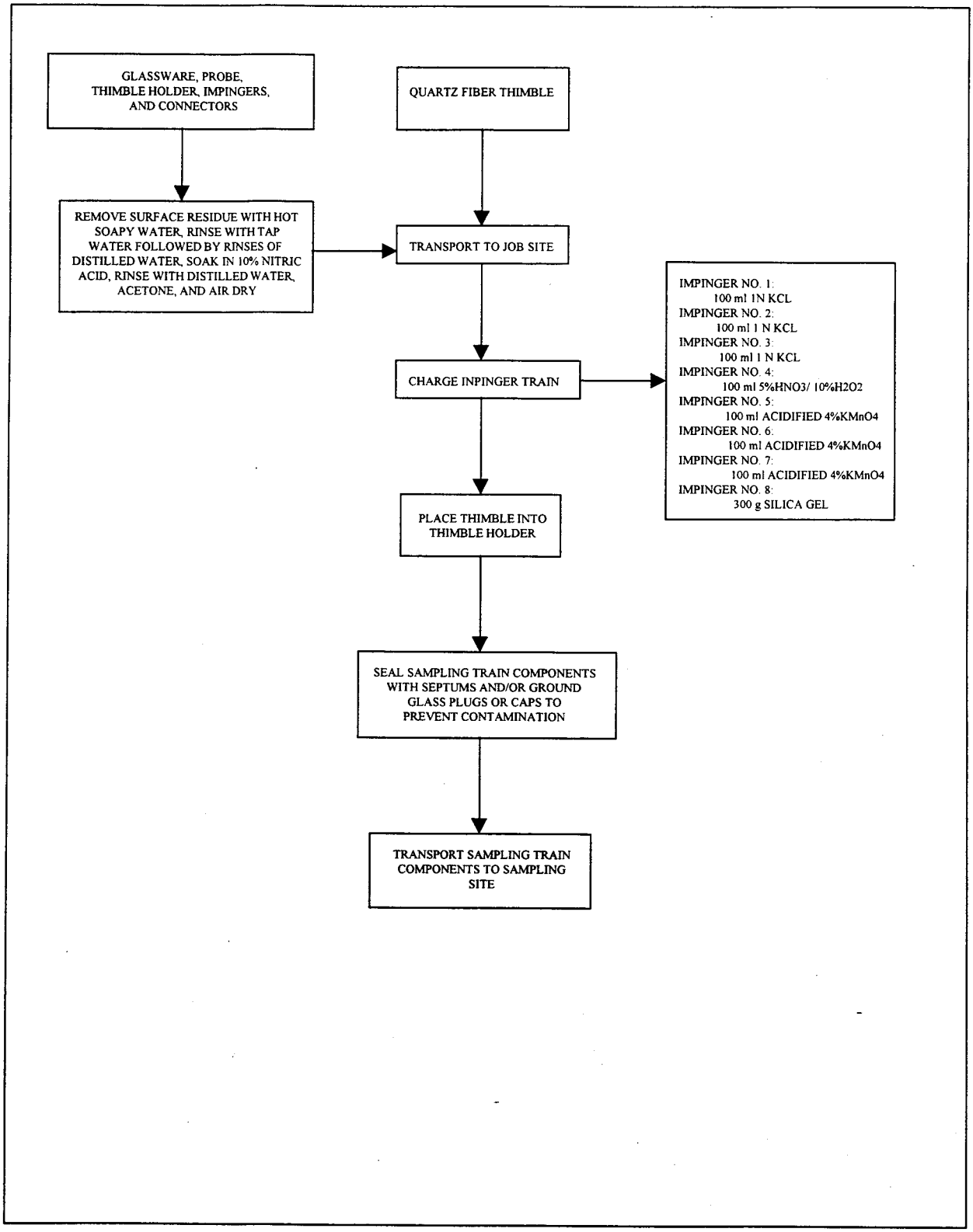

FIGURE 4-3
PREPARATION PROCEDURES FOR ONTARIO HYDRO SAMPLING TRAIN

DOE20-D20

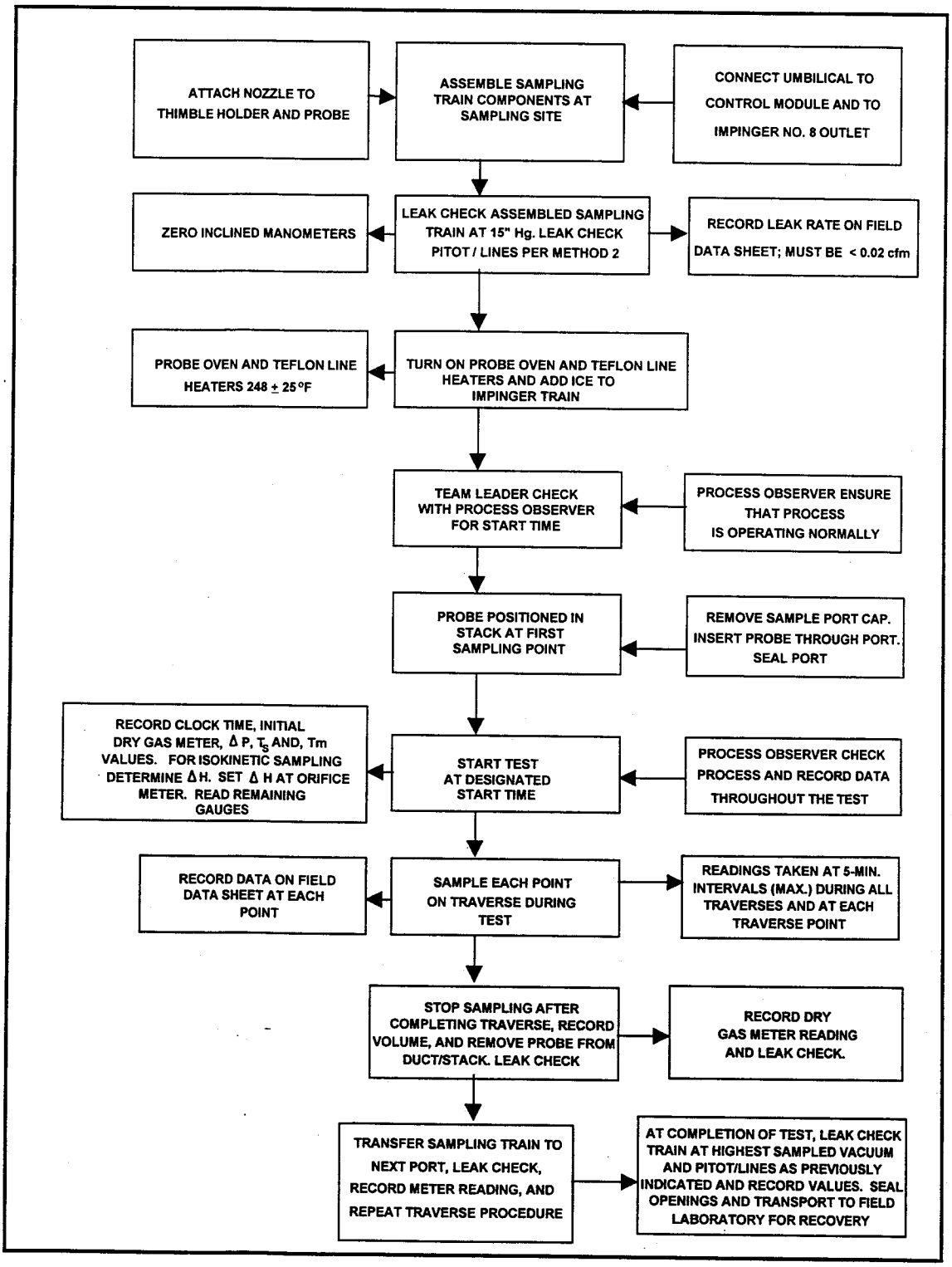

FIGURE 4 - 4
SAMPLING PROCEDURES FOR ONTARIO HYDRO TRAIN

DOE21-D20

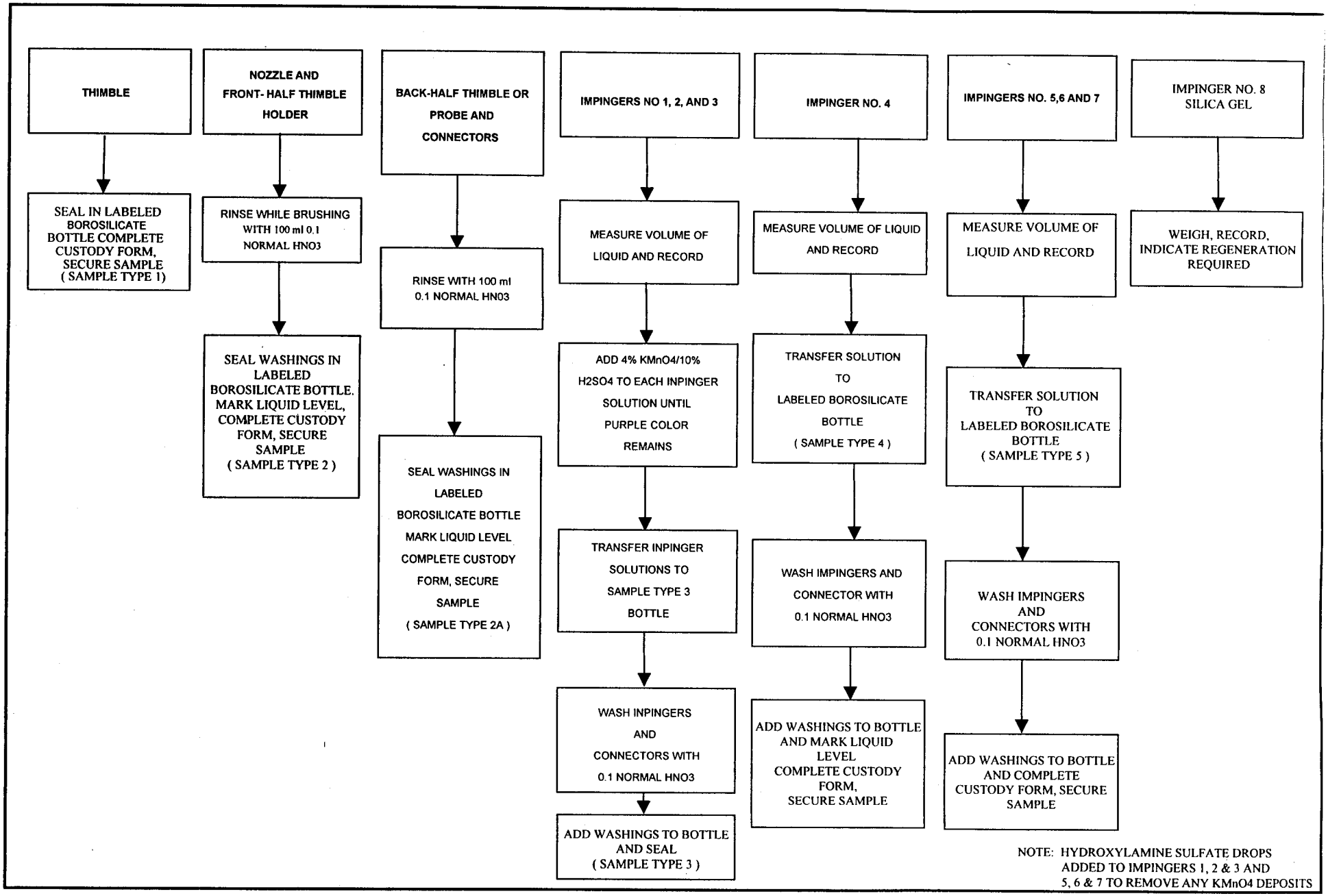

FIGURE 4 - 5
SAMPLE RECOVERY PROCEDURES FOR ONTARIO HYDRO METHOD

DOE22-D20

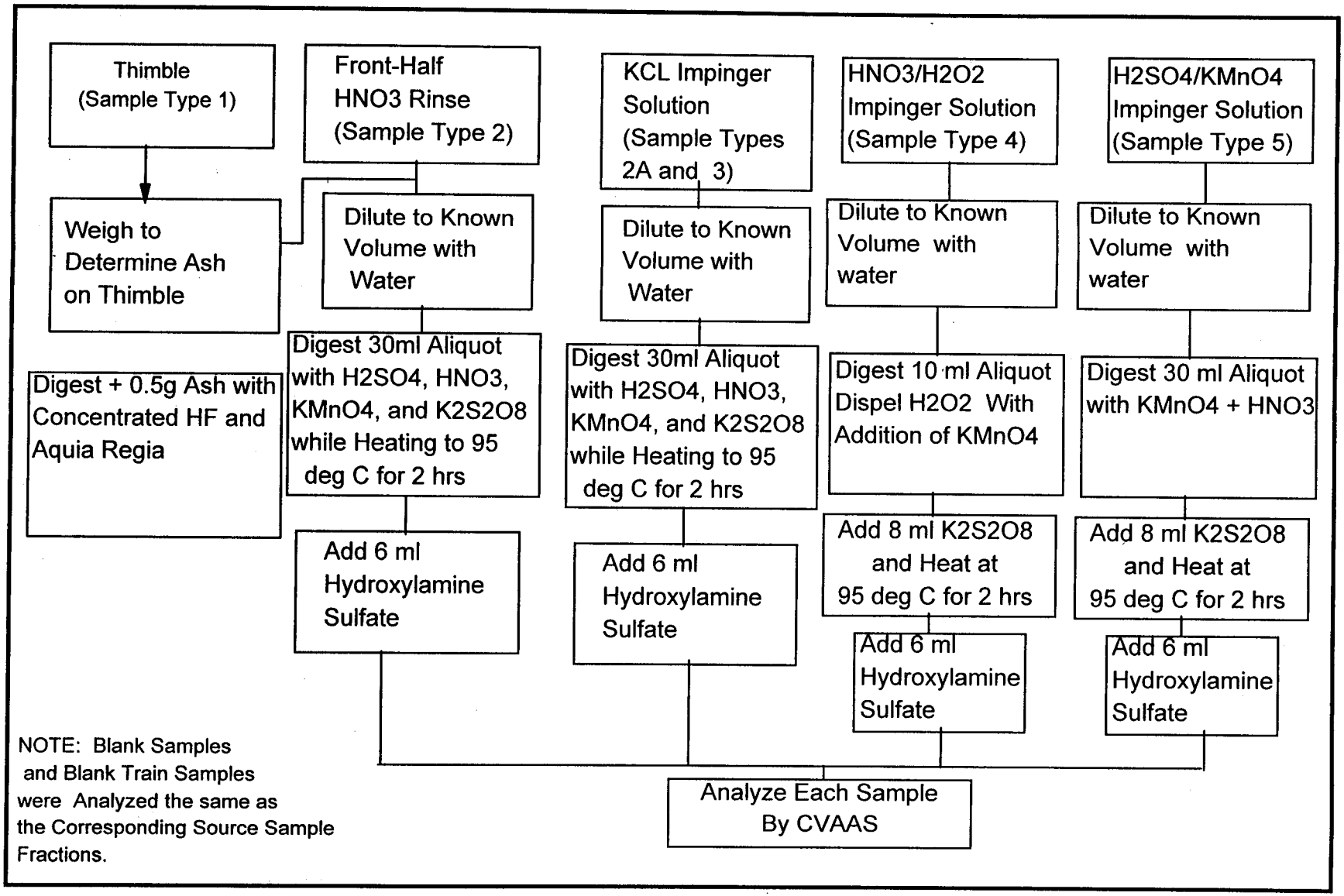

FIGURE 4 - 6
ANALYTICAL PROCEDURE FOR
ONTARIO HYDRO SAMPLING TRAIN

c:\freelance drawing\Fig5-7.prz

4.4.1.2.4 Ash, Sulfur and Heating Value

The prepped coal samples were analyzed for ash, sulfur content and heating value using ASTM Methods D3174, D4239 and D3286, respectively.

5. QUALITY ASSURANCE SUMMARY

This section discusses results for QC samples collected during the test program. Discussions are provided for stack gas samples (Subsection 5.1) and coal samples (Subsection 5.2).

5.1 STACK SAMPLE QA/QC RESULTS

This section provides detailed information regarding the QA/QC activities associated with stack sample collection, analysis, and reporting.

This summary pertains to all test data collected from sampling activities performed on Unit No. 1 during the period of November 1 and 2, 1999. Analyses were performed on these samples for speciated mercury.

Project data quality objectives, as measured by precision, accuracy and completeness, were evaluated. Additionally, holding times, spike recoveries, laboratory blanks, and calibrations were evaluated to determine overall data quality based on criteria specified in the Site-Specific Sampling/Testing, Analytical and QA/QC Plan and the Quality Assurance Project Plan.

5.1.1 Stack Sample Collection and Calculations

Field QA/QC activities associated with the collection of stack Ontario Hydro method emission samples included pre- and post-test calibrations of sampling equipment, adherence to the proper sampling method procedures, documentation of field data, recovery of samples without contamination, and collection of appropriate field train and site blank samples.

Copies of the field data sheets are contained in Appendix C. Chain of custody forms are included in each laboratory report and provide a list of all samples collected and submitted for analysis during the test program. The laboratory reports are provided in Appendix D.

Proper field sampling procedures include sampling at 100% isokinetic ±10% and maintaining sample train leakage rates at ≤ 0.02 CFM. Table 5-1 contains a summary of all isokinetic

Table 5-1

Stack Emission Sampling Field QA/QC Results

Test Location	Test Run	Isokinetic Sampling Rate[1]	Initial Leak Check Rate[2]	Final Leak Check Rate[2]	Gas Meter Calibration Values[3]	
					Pre	Post[(4)]
Unit No. 1 Outlet	1	100.8	0.008	0.009	0.9961	0.9840
	2	102.4	0.008	0.008	0.9961	0.9840
	3	101.2	0.015	0.012	0.9961	0.9840

1 Isokinetic rate must be 100 ± 10%. All sampling rates met isokinetic criteria.

2 Initial and final leak check value must be ≤ 0.02 CFM. All leak checks were acceptable.

3 Post-test calibration must be ± 0.05 of pre-test value. All calibration values were acceptable.

4 Based on EPA alternative post test calibration procedure.

Note:

Silica gel impinger exit temperature maintained < 68°F during all test periods.

sampling rates for all tests, initial and final leak check rates, and pre- and post-test dry gas meter calibration results. This table indicates that all test runs were within the acceptable ranges for all field measurements. Appendix F contains the stack test equipment calibration data.

5.1.2 Sample Chain of Custody

Sample custody procedures were followed per Section B-2 of the QAPP. The sample storage area was locked and secured during off-hours when test representatives were not on-site. Following collection and recovery, all samples were transferred under chain of custody to representatives of Philip Analytical Services Laboratory located in Reading, Pennsylvania. All samples arrived in good condition to the Philip laboratory.

5.1.3 Stack Emission Blank Sample Results

Blank samples were submitted with the stack emissions samples as designated in the test method and QAPP. During each set of the three test runs, a blank sample train was setup, leak checked and recovered at the stack test location on Unit No. 1. Site blanks of the thimbles, impinger train solutions and recovery solutions were retained and analyzed. No mercury above the analytical detection limit was present in any of the site blank samples collected for Unit No. 1. No mercury above the analytical detection limit was found in any of the blank train fractions at the outlet test location.

5.1.4 Ontario Hydro Analysis Holding Times

Holding time is the period from sample collection to sample analysis. All holding times for all Ontario Hydro sample parameters were within the maximum time period of 28 days per the Site-Specific Sampling/Testing Analytical and QA/QC Plan.

5.1.5 Internal Field Audit Procedures

During the performance of the test program, the WESTON field team leader performed an audit of the field measurement activities. A field audit checklist (Technical System Audit) was used to document the internal audit. The audit included examination of field sampling records, field

instrument operating records, sample collection, recovery, handling and chain-of-custody procedures. A copy of the Technical System Audit is provided in Appendix G.

5.1.6 External Performance Evaluation Audits

No performance evaluation audits were provided to WESTON by the regulatory agencies during the test program.

5.1.7 Ontario Hydro Sampling QA/QC Conclusion

All mercury speciation stack emissions data and results are representative of the emissions encountered during the test periods and are acceptable following QA/QC review.

5.1.8 Ontario Hydro Sample Analysis

Each Ontario Hydro sample was analyzed in duplicate and every 1 in 10 samples were analyzed in triplicate. The relative percent difference (RPD) for duplicate analysis is $\leq$ 20%. With the exception of a few samples which contained low levels of mercury near the detection limit, the RPD criteria was satisfied.

The accuracy criteria for spike samples and laboratory control samples is 80 to 120%. This criteria was satisfied in all cases.

5.1.9 Ontario Hydro Sample Analysis QA/QC Conclusion

All source sample data and results are acceptable following QA/QC review.

5.2 PROCESS SOLID SAMPLE QA/QC RESULTS

The Site-Specific Sampling/Analytical and QA/QC Plan and the QAPP for this program identified the analytical QC objectives for the process solid sample analysis.

All QA/QC analysis results are provided in Appendix D of this report. A brief summary of the results follows.

Analytical Precision

Analytical precision was determined by RPD obtained by the duplicate sample analyses. The RPD objective for the mercury and chlorine in coal was ≤ 20%. The RPD for ash, sulfur and heating value is ≤ 10%. The RPD objectives for duplicate analyses were met in all cases for all analytes.

Analytical Accuracy

The objectives for accuracy for spike samples and laboratory control samples were 70 to 130% for the mercury in coal and 80-120% for chlorine. The objectives for accuracy were satisfied in all cases.

5.2.1 Holding Times

All coal samples were analyzed within the required holding times as specified in the Site-Specific Sampling/Testing, Analytical and QA/QC Plan.

5.2.2 Process Sample QA/QC Conclusions

All solid sample process data and results are acceptable following QA/QC review.

5.3 COMPLETENESS

Laboratory completeness is a measure of the amount of valid measurements obtained from all the laboratory measurements associated with this test program. The number of valid measurements satisfied the laboratory completeness goal identified in the Site-Specific Sampling/Testing, Analytical and QA/QC Plan QAPP of greater than 90 percent.

Based on a review of all QA/QC results, no data has been lost or qualified as not satisfied the QC criteria for precision and accuracy. Therefore, a 100% completeness can be assigned for both sampling and analysis.